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ABSTRACT

The study tested a hypothesized three-dimensional structure of test anxiety involving the constructs of fear of failure, emotionality, and worry. The discriminant validity of these three constructs was studied. Uninformed students were told about a mathematics test in a lesson just prior to administration. They were compared to informed students who were advised a week in advance of the test administration. The findings supported the existence of worry and emotionality as response factors separate from fear of failure. Fear of failure is concerned with the individual's tendency to anticipate negative effects in achievement situations. Worry is a cognitive concern, characterized by self-focusing. Emotionality refers to the tendency of experiencing actual autonomic arousal and unpleasant states such as nervousness and tension. The interfering effects of fear of failure and emotionality on test performance were weakened in the informed condition; impact of the worry factor was most evident in the informed condition. The individual's performance expectancy is related to worry and less strongly to emotionality. The results of the study suggested that common testing procedures activate fear of failure, emotionality, and worry. Performance decrements seem most closely related to the cognitively oriented worry factor. (DWH)

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A CONSTRUCT VALIDATION STUDY OF TEST ANXIETY:

A discriminant validation of fear of failure, worry and emotionality [1,2)]

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1. THEORETICAL CONSIDERATIONS

Mainstream conceptualizations of test anxiety are being made in terms of worry, emotionality and fear of failure. These constructs obviously appear related. Conceptual differences, however, make it worth while to simultaneously investigate their discriminant validity (Campbell & Fiske, 1959). Studies based on these conceptualizations have mostly been based on either the distinction between worry and emotionality or on the construct of fear of failure. Few investigations have explored their interrelations or compared their relationships to other variables. Studies incorporating these three constructs appear, however, desirable in the service of elaborating the theory of test anxiety.

The point of departure of the present study was derived from a domain study of test anxiety (Hagtvet, 1976, 1981a). The findings were interpreted to support either the worry-emotionality distinction or a hierarchical structure consisting of three factors; a second order factor, going through a situationally defined domain of test anxiety, and worry and emotionality as two primary group factors. The second order factor was interpreted to reflect a general sensitivity of evaluative situations, i.e. a predisposition of being concerned with fear of failure. As suggested by Atkinson (1964, 1974) and indicated by Spielberger (1966), a general anxiety trait may be interpreted in terms of fear of failure or a motive to avoid failure. If a general anxiety trait primarily consists of fear of failure, this suggestion should apparently be an even more plausible expectation for the situation specific

trait of test anxiety. The motive to avoid failure has frequently been empirically anchored in the scores on test anxiety scales (Atkinson, 1964; Nygård & Gjesme, 1973).

In the McClelland - Atkinson tradition of the achievement motivation research the motive to avoid failure is defined and measured as a unitary construct (Atkinson, 1964, 1974; Atkinson & Feather, 1966; McClelland et al., 1953). Fear of failure is regarded as a personality characteristic in terms of a capacity to anticipate negative affects in achievement situations. Even though the cognitive aspects of anticipating the affective situation may be clearly recognized, central to this conception of fear of failure are the affects involved in an achievement oriented or evaluative situation.

Birney, Birdick and Teevan (1969, 200-225) have suggested a three-headed construct of fear of failure based on the experience of nonattainment which can take any or all of the three following forms; 1) lowered self-estimate, 2) the receipt of a non-ego punishment, and 3) a reduction in one's social value. Central to their conception of fear of failure is the notion that nonattainment fear is an aversive reaction to cues that signal future failure. They have also described three types of defensive maneuver that in part will depend on the specific type of failure fear. However, it seems unclarified whether the three-headed taxonomy is applicable to failure expectations, and to defensive strategies following upon failure experiences. It has been suggested by Vislie (1971) that their

Hostile Press measure of fear of failure apparently measures a generalized avoidance reaction. A recent report by Ceranski, Teevan and Kalle (1979) clearly supported the construct validity of the Hostile Press code as a unitary measure of fear of failure. Two other measures of fear of failure in the same study, a modified Test Anxiety Questionnaire (Mandler & Sarason, 1952) and a resultant achievement motivation measure did not produce findings that supported crucial hypotheses on defensive - and preference behavior derived from achievement motivation theory (Atkinson, 1964).

Parallel to the Hostile Press measure is the German code for scoring fear of failure which emphasizes "... direct expression of need to avoid failure, such as anticipation of possible task failure, negative affect about failure, action to avoid or undo failure, failure outcome, negative social consequences as being blamed and preoccupation with failure as the theme of the story". (Heckhausen, 1975, 118).

Later Schmalt (1973,1976,1982)has developed a semi-projective measure of fear of failure. The fear of failure motive in German research, however, has unexpectedly been found to be bidimensional in nature (Jopt, 1974 (cited in Heckhausen, 1977); Schmalt, 1973, 1976). This appears contradictory to achievement motivation theory (cf.: Schmalt, 1976, 115). The two fear of failure factors were labelled 1) "Konzept mangelnder eigener Fähigkeit und Initiation von Handlungen zur Abwendung von Misserfolg" and 2) "Furcht vor Misserfolg" (Schmalt, 1976, 113) [3].

According to Schmalt (1976, 119) these fear of failure factors appear to have a clear relationship to the worry and emotionality constructs of test anxiety.

Liebert and Morris (1967) defined worry as "primarily [a] cognitive concern about the consequences of failing, the ability of others relative to one's own, etc." (p. 975). The worry construct has later been incorporated in the framework of trait-state anxiety theory (Spielberger et al., 1976, 1978) as a major component of test anxiety indicating self-centered responses. The self-focusing aspect of worry has been considered a key construct in a cognitive - attentional approach to test anxiety (Sarason, I.G., 1972, 1975a, 1975; Wine, 1971, 1980). This aspect is probably most thoroughly explicated by I.G. Sarason (1975b,35)who states:"Perhaps anxiety, while important, is not quite so pivotal. Perhaps the more basic process is not anxiety, but self-preoccupation or self-focusing".

Emotionality refers to "autonomic reactions which tend to occur under examination stress" (Liebert & Morris, 1967, 975), and it is considered another major component of test anxiety by Spielberger et al. (1979).

So far, this conceptual presentation should make it clear that both similarities and distinctiveness appear to exist between the fear of failure and the worry-emotionality constructs. However, to make a sensible comparison between these constructs some points should be made clear.

1) The fear of failure construct seems primarily to deal with the capacity to which individuals anticipate affects in the situational context of evaluated performance,2) Fear of failure has been treated as a universal concept not confined to specific school and test situations only , 3) Worry and emotionality have primarily been construed as specific response factors (Liebert & Morris, 1967; Spielberger, et al. 1976, 1978, 1979). The fact that fear of failure is often explicated as part of an arousal theory while worry and emotionality are better conceived of as part of an interference type of theory testifies to their conceptual distinctiveness. Given that test anxiety has the characteristics of a class of constructs which Campbell (1963) named"acquired behavioral dispositions", a meaningful comparison between these test anxiety components seems to be possible. With reference to Campbell's distinction between perceptual - and response - oriented dispositional concepts, it may be suggested that the construct of fear of failure is primarily a motivational-perceptual-oriented term which constitutes an explicit condition for affective arousal (cf. McClelland et al., 1953). Worry and emotionality on the other hand, are presumed to be response-oriented constructs that accompany the fear of failure experience.

To investigate the operation of fear of failure, worry and emotionality, current theory and research suggest inclusion of situation parameters combined with person parameters (Deffenbacher, 1980; Nygård, 1981a,b; Spielberger et.al., 1976). In accordance with achievement motivation theory, the arousal of fear of failure is dependent upon situational uncertainty

as to the outcome (Atkinson, 1964, p. 241). Emotionality and worry may be evoked by different situational cues. In accord with Deffenbacher (1980) emotionality may be evoked by cues signalling the beginning of an exam or actual confrontation with an evaluative threat. Worry, on the other hand, appears to be a function of conditions varying with respect to possible experience of failure. However, I.G. Sarason (1975 b) asserted that constructs like worry "... are not completely at the mercy of changes in stimulus conditions..." (p. 28).

In conclusion, it may be suggested that fear of failure, worry and emotionality are pointing to different foci of individual differences of test anxiety. There are already a number of both factor analytic studies (Hagtvet, 1976, 1980; Schwarzer, 1982; Spielberger et al., 1978, 1979; Van der Ploeg et al., 1980) as well as external reference studies (cf. Deffenbacher, 1980) which support the discriminant validity of worry and emotionality as two components of test anxiety. However, little is known whether worry and emotionality are distinctive constructs different from fear of failure. When investigating the discriminant validity among these constructs, the importance of implementing situational variation is easily derived from current theory and research.

To approach the problem of discriminant validity an observational explanatory study (Cooley, 1978; Jøreskog, 1976) was designed. The three constructs' relation to anxiety-state (Spielberger, 1966) and to performance on tests of mathematics, respectively, under two different situational conditions of evaluative stress, were investigated.

2. EMPIRICAL STUDY

2.1 METHOD

Situational conditions

A clue to a situational variation relevant to the present research problem was adopted from Krohne and Schaffner (1980) who emphasized the importance of taking into account anxiety-related processes preceding a testing situation as well as those being active in the actual testing situation. A quasi-experimental manipulation (Cook & Cambpell, 1979) was carried out by randomly assigning school classes to the following two conditions: pupils were not informed beforehand about a test in mathematics except in the lesson just prior to the test administration, (uninformed), compared to the other group where pupils were informed a week in advance of the test administration (informed). A question was asked after the test administration about whether the pupil did know about the test. Based on this question the group membership was determined. Only in a quite few cases pupils did have their group membership changed.

Subjects

The informed and uninformed groups consisted of 109 and 52 pupils respectively in grade 9 of the Norwegian Basic School, in a community outside of Oslo.

Measures

a) The Norwegian National Mathematics Battery

This battery consisted of four subtests; arithmetic (ARIT),

algebra (ALGE), geometry (GEOM) and applied mathematics (APMAT) (Grunnskolerådet 1981). They were administered in this order. The present study obtained alpha coefficients of .89, .90, .87 and .81 for the ARIT, the ALGE, the GEOM and the APMAT subtests, respectively. At the start of the test all the pupils were 1) informed about the time limit of 90 minutes and 2) encouraged to work fast and accurate.

b) The Norwegian Achievement Motives Scale (AMS)

The fear of failure construct was assessed by a 15-item subscale of the AMS developed by Gjesme and Nygård (1970; Nygård & Gjesme, 1973; cf. Rand, 1978). This scale is explicitly linked to the theory of achievement motivation explicated within the McClelland-Atkinson tradition (Atkinson, 1958; McClelland, 1955; McClelland et al., 1953). A number of supportive construct validation studies have been reported by Gjesme (1971, 1974, 1975), Nygård (1977), Bø & Rand (1979), Rand (1978); Bø, Christophersen and Rand (1980) and Christophersen and Rand (1982).

c) The Norwegian version of Test Anxiety Inventory (TAIN)

Worry and emotionality were measured by means of the Spielberger Test Anxiety Inventory (Spielberger et al., 1979). Introductory try-outs of the scale in three independent samples in Norway have provided evidence for both discriminant and factorial validity of the worry and the emotionality subscales (Hagtvet, 1981b).

The questionnaire scales of fear of failure, worry and emotionality were administered one month in advance of the maths test.

d) The Norwegian State-Trait Anxiety Inventory (STAI)

The anxiety state was measured by a slightly revised version of the Norwegian form of the STAI developed by Håseth (1978). The scale was administered at three points in time; 1) one week in advance of the maths tests with reference to an ordinary lesson in mathematics (A-CLASS), 2) the lesson just prior to the maths tests (A-PRE) and finally, 3) the lesson after the testing situation with reference to how they felt during the maths test (A-DUR).

Data analysis

It was decided to include the three described test anxiety components into a causal model for explaining variance in mathematical performance and anxiety-state scores respectively under the informed and the uninformed conditions. The choice of the causal model assumed a prescribed set of causes without any relation between causes. Before suggesting important paths between causes it seems desirable to provide evidence for the existence of all causes in the present context. To meet this requirement a newly invented criterion oriented factorial modeling procedure (Lohnes, 1979) appeared to be a proper choice. This procedure relates latent variables to a set of criterion measures. The latent variables have to be specified by two or more observed variables. In the present context the fear of

failure was specified by a 7-item - and a 8-item scale, respectively, (MF 1 and MF 2), generated from an arbitrary split of the 15 items constituting the fear of failure subscale of the AMS. Likewise the specifying variates for worry were derived from the TAIN and consisted of a 5-item and a 6-item scale (W 1 and W 2); and the emotionality factor was specified by a 3-item and a 4-item scale, (E 1 and E 2) [4]. Suggestions for ordering causes into the model were derived from current research and the intentions of the present study. The fear of failure construct assumed to be a motivational-perceptual oriented term was first inserted into the model. Then it could be considered if emotionality and worry as response constructs might add information beyond fear of failure in explaining criterion variance. Furthermore, most external reference studies have supported unique contribution of worry to performance variance when controlling for emotionality, but not vice versa. Thus, measures of fear of failure, emotionality and worry in this order were inserted into the causal model. Obviously, worry will obtain the most conservative estimate of its contribution compared to the other two components. However, if it still makes a substantial contribution, its impact is considered as rather more impressive.

2.2 RESULTS

Structural relationships between test anxiety and anxiety state

The correlation matrices for the uninformed and the informed condition are presented in Tables 1 and 2 respectively. Tables 3 and 4 report the parameters of the corresponding FaM model

for which Figures 1 and 2 recapitulate the most salient features by omitting coefficients equal to or below .20 [5].

Insert Figures 1 and 2 about here

Each of the Tables 3 and 4 and the corresponding Figures 1 and 2 give essentially two types of information. First, a confirmatory factor analysis which informs about the measurement of the different factors, and secondly, the structural relationships between these factors and the anxiety state measures. In both conditions the respective models supported a three factor solution. Even though the first factor was exclusively specified by the fear of failure indicators, MF 1 and MF 2, this factor also correlated substantially with the emotionality and the worry indicators which suggested a general factor interpretation. The factor loadings made it sensible to label the general factor fear of failure. Beyond the fear of failure factor the data provided evidence for the existence of both emotionality and worry. However, the loadings on the worry factor in the uninformed condition were not considered satisfactory.

Concerning the structural relationships both the fear of failure factor and the emotionality factor explained substantial and independent parts of the anxiety-state variance in both conditions. There is, however, evidence that the relations between test anxiety dispositions and anxiety state are dependent on situational conditions. The impact of fear of failure on the anxiety state just prior to and during the maths tests was more

pronounced in the uninformed condition, while the contribution from the emotionality factor was more salient in the informed condition. The impact of emotionality compared to fear of failure on the same anxiety state measures appeared to be stronger in the informed condition. Worry was uniquely (Cohen & Cohen, 1975), related to anxiety state just prior to and during the maths tests in the informed group, while it was uniquely related only to anxiety state during the maths tests in the uninformed condition. One also recognized that the fear of failure and the emotionality factor were related to anxiety-state in an ordinary lesson in mathematics. The fact that all three test anxiety dispositions were clearly related to anxiety-state measures in both groups indicated that both conditions were achievement oriented or contained evaluative elements although to different extent. As would be expected mean values on anxiety state measures were significantly higher in the uninformed condition just prior to and during the maths tests, APRE; $t(1,158)=4.56, p<.01$; ADUR; $t(1,159)=2.48, p<.02$, which correspond to point-biserial (r_{pb}) correlations of .34 and .19, respectively. However when controlling for test anxiety dispositions, the two groups differed significantly only on anxiety state prior to the maths tests, $F(1,158)=13.36, p<.01$, which in turn indicates an $r_{pb}=.28$.

Structural relationships between test anxiety and mathematics.

The correlations matrices for the uninformed and informed groups are reported in Tables 5 and 6, respectively. The obtained FaM models are presented in Tables 7 and 8 [5], while the most outstanding features are depicted in Figures 3 and 4.

Insert Figures 3 and 4 about here

A support for the hypothesized three dimensional structure was also derived from these FaM model applications. In fact, the structural relationships seemed more situationally specific than the one presented in Figures 1 and 2 with anxiety state measures as criterion variables. The uninformed subjects model displayed the fear of failure factor and the emotionality factor contributing moderately to variance on three of the four maths tests, while worry did not seem to have any strong unique impact. In the informed subjects model, the impact of fear of failure and emotionality were greatly reduced, whereas the worry factor contributed to the variance in two of the three maths test; worry was related to both algebra and geometry even when the contribution from both fear of failure and emotionality were controlled for. The subtest measuring applied mathematics was not related to anxiety in either condition. Interestingly, abstract symbols and mathematical notation were distinctive features of the subtests measuring algebra and geometry.6)

2.3 DISCUSSION

The primary purpose of the present study was to empirically test a hypothesized three dimensional structure of test anxiety involving the constructs of fear of failure, emotionality and worry. Theory-based measures of these constructs coupled

with a situational variation were included in the present research design. A conceptual analysis suggested a causal ordering of factors by giving highest priority to fear of failure and lowert to worry. Given this causal ordering both the confirmatory factor analyses and the structural relationships of the applied models provided support for the hypothesized structure of test anxiety. Indicators constructed to measure fear of failure, emotionality and worry were positively intercorrelated as was expected. A distinctive aspect of fear of failure, however, was assumed to primarily consist of motivational-perceptual prosesses. This aspect may also very likely be measured by indicators of both worry and emotionality to some extent. If this reasoning holds, it may be expected that the fear of failure factor should be loaded by indicators of worry and emotionality. The obtained factor structure supported a general factor interpretation of fear of failure. Nevertheless, beyond the general fear of failure factor the findings provided support for the existence of both worry and emotionality as separate response factors.

Additional evidence for discriminant validity of the three test anxiety components may be derived from a comparison of structural relationships obtained in the different situational conditions. Of specific interest is the differential operation of the fear of failure factor compared to the emotionality factor. Conceptually speaking both constructs are dealing with affects. However, it is suggested that fear of failure is primarily concerned with the individuals' tendency to perceive testing

situations and other evaluative situations as threatening or personally dangerous, i.e. to anticipate negative affects in achievement situations. Emotionality, on the other hand, refers to the tendency of experiencing actual autonomic arousal and unpleasant feeling states such as nervousness and tension. Support for their discriminant properties are best seen in the present study in their relations to Anxiety-state just prior to the maths tests in the two situational conditions. Based on the different mean values on the Anxiety-state measures referred to above, it seems reasonable to assume that the uninformed group experienced the situation just before being confronted with the maths tests as more threatening than the informed group. Given this assumption it is quite reasonable to expect the fear of failure factor to correlate higher with Anxiety-state in the uninformed than in the informed condition. The emotionality factor, on the other hand, did not reduce its relationship with Anxiety-state when going from the uninformed to the informed condition as did the fear of failure factor. During the maths tests, however, both fear of failure and emotionality displayed relatively constant relationships to Anxiety-state obtained under both conditions. This appearently different situationally dependent arousal pattern may support the notion that fear of failure is concerned with perceptual processes that may be modified by manipulating the information about the future test. Emotionality, on the other hand, may deal with processes of autonomic nature which is easily elicited in situations that contain to some extent evaluative cues. However, the interfering effects of both fear of failure and emotionality on test performance are both greatly weakened in the informed condition.

The operation of worry appeared also to support the discriminant validity of the three-headed test anxiety construct. No matter whether measures of Anxiety state or mathematics were used as criteria, the contribution of fear of failure and emotionality were too strong to leave any noticeable unique impact of the worry factor in the uninformed condition with two exceptions; worry appeared to be uniquely related to 1) Anxiety state during the maths tests and 2) the arithmetic subtest. On the other hand, the unique impact of the worry factor was most clearly displayed in the informed condition. Also when the emotionality factor was forced to enter as the last factor in the multivariate regression, no unique contribution in any of the maths variables were obtained. These relationships may indicate that the tendency to worry is easily maintained in the pretesting period and are still strong enough when facing the testing situation to interfere with performance given that pupils are informed about the test a week in advance. The data of the present study do not provide any explanation of this relationship. However, prior research suggest that the individuals' performance expectancy seems to be a critical variable. Studies by Liebert and Morris (1967), Morris and Liebert (1970) and Spiegler, Morris and Liebert (1968) suggest that performance expectancy is clearly related to worry and less strongly related to emotionality.

One of their studies (Spiegler et al., 1968) displayed that a negative relationship between worry and performance expectancy was relatively stable from 5 days before to just after an important examination. No corresponding relation with emotionality was found. These findings may suggest that performance expectancy may in part account for the unique operation of worry in the informed condition in the present study. In line with this suggestion, it may be of highly interest to research possible differential relationships of worry, emotionality and fear of failure with performance expectancy at different levels of stress.

When comparing findings from the two conditions, the increase of the unique impact of the worry factor was associated with a reduction of the contribution of the fear of failure and the emotionality factor. This trend was most distinctive when using the maths tests as criterion variables. When taking all the four FaM models into account the nature of the structural relationships appeared to covary with the experienced intensity of the Anxiety-state measured just prior to and during the maths tests; that is, when the intensity of the Anxiety-state increased, the unique impact of worry decreased. However, whether the shift in structural realtionships, as refered to above, may be entirely caused by the different points in time the subjects were informed about the coming test, cannot be answered in the present study due to its quasi-experimental manipulation.

It should be noted that the present findings of the informed group are mostly in accordance with the frequently obtained relation-

ships emphasizing the importance of worry compared to emotionality in accounting for performance decrements. However, in the uninformed group the semipartial correlation between the emotionality factor (controlling for both fear of failure and worry) and the algebra and geometry variables were -.24 and -.20, respectively. Thus, the present data provided some evidence for stating that both emotionality and worry may uniquely contribute to performance decrements. Their relative unique importance may depend upon the level of the Anxiety state; i.e. when the intensity of the Anxiety state is increased, unique impact of worry may be less likely, while the unique import of emotionality may increase and vice versa.

The present findings also indicated that the obtained relationships may depend upon the type of criterion variable used. In the present report algebra and geometry appeared to be the most interesting maths variables, probably because they contained the largest amount of abstract symbols and mathematical notation compared to the subtest of arithmetic and applied mathematics.

Since a common way of administering tests and examinations at all levels of the school system is mostly in correspondance with the informed condition in this study, an implication may be suggested. Based on the present study it is suggested that common testing procedures activate both fear of failure, emotionality and worry. However, the most salient factor in explaining performance decrements still appears to be the cognitively oriented worry factor.

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FOOTNOTES

1) This research was supported by grants from the University of Bergen, Norway. Requests for copies should be addressed to Knut A. Hagtvet, Institute of Psychology, University of Bergen, Sydnesplass 13, N-5000 Bergen, Norway.

2) I am greatly indebted to Marit Granheim who organized and carried out the data collection besides scoring the maths tests; to Tom Edw. Eriksen who assisted in the data processing and finally to Sigrun Jernquist who provided valuable information and suggestions in using the maths tests.

3) In English translation: 1) "Self - concept of lack of ability combined with a tendency actively to circumvent failure", and 2) "worry about failure". (Heckhausen, 1975,120).

4) An item analysis revealed that two emotionality items operated as the other emotionality items only in the uninformed condition. This was very likely due to the phenomenon of "item-intensity specificity" noted by Spielberger and Sharma (1976). It was, however, decided to exlude these two items from the present data analysis.

5) The correlation matrices and the corresponding FaM models are available from the author.

6) For the purpose of comparing structural relationships from different conditions, FaM models were also obtained based on covariance matrices (cf. Ackerman & Lohnes, 1981, 185-189; Blalock, 1967; Jøreskog, 1971). Corresponding models based on covariance and correlation matrices respectively, provided identical results practically speaking. FaM models based on covariance matrices are also available from the author.

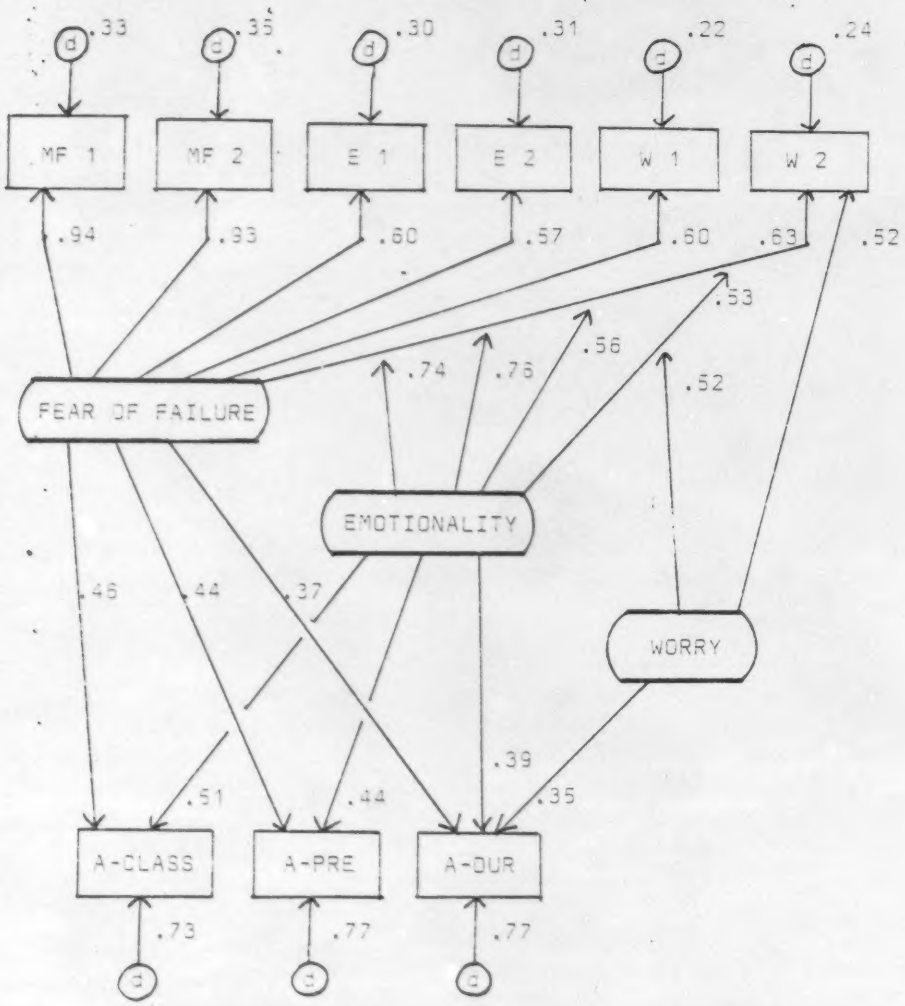

Figure 1. FaM - model for the uninformed group

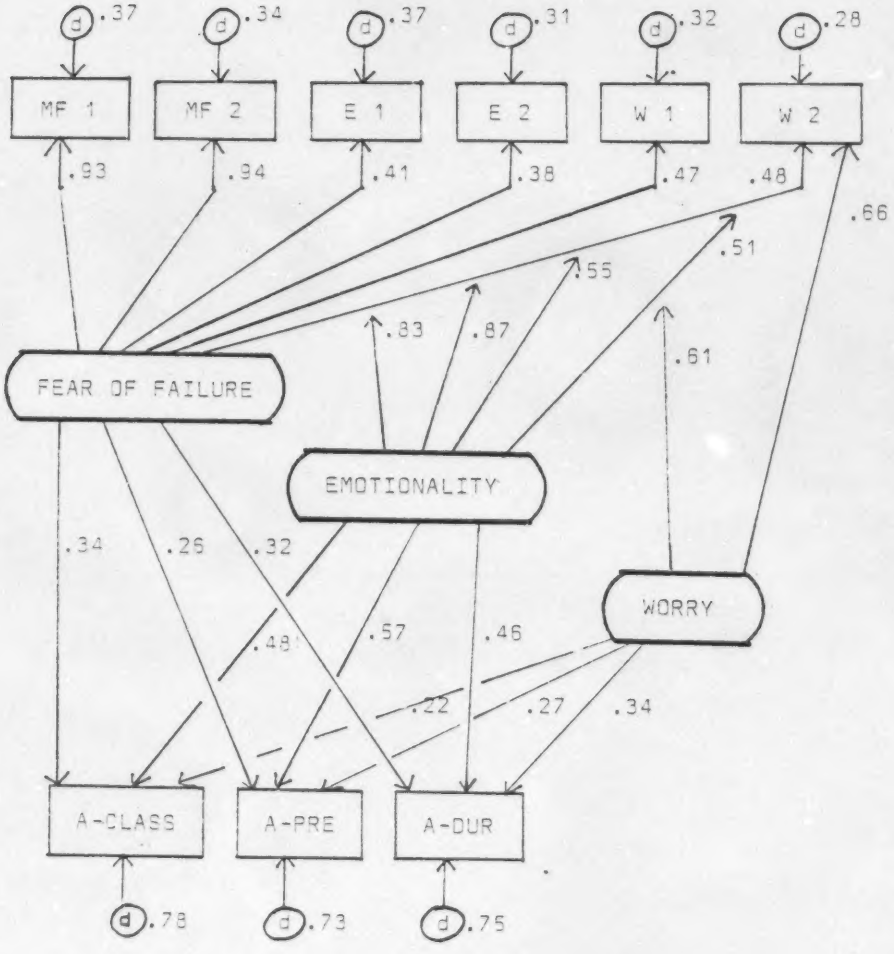

Figure 2. FeM - model for the informed group

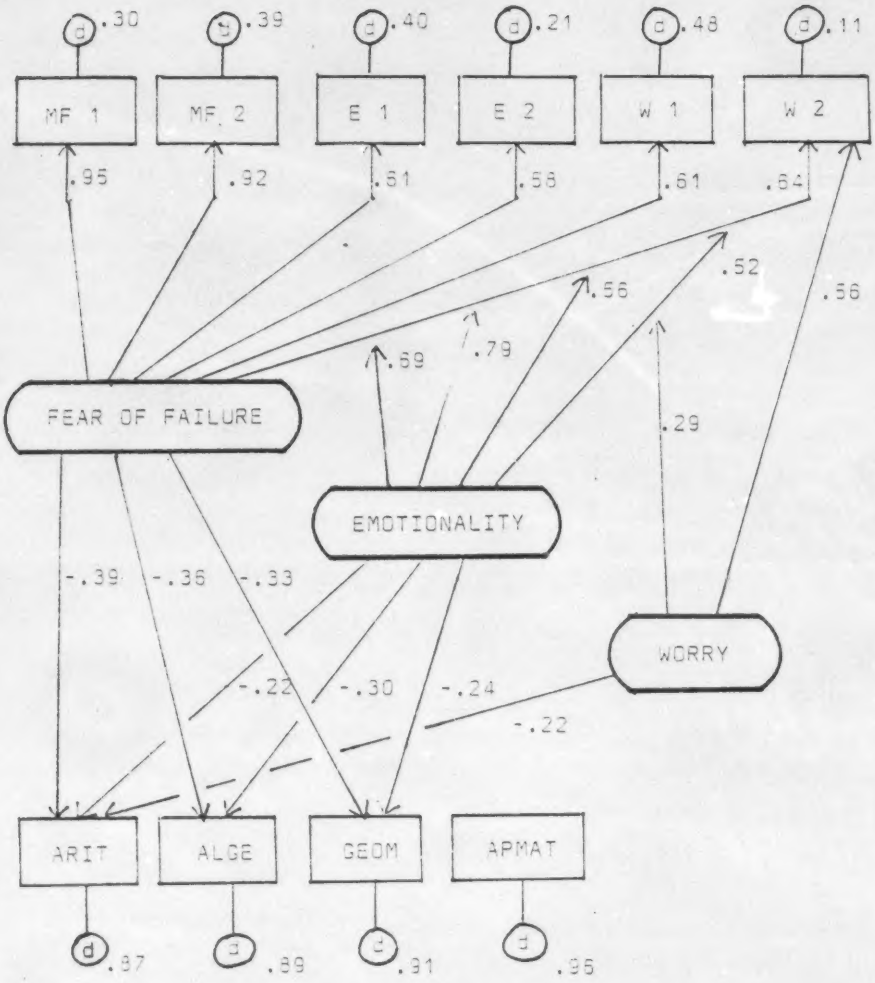

Figure 3. FaM - model for the uninformed group

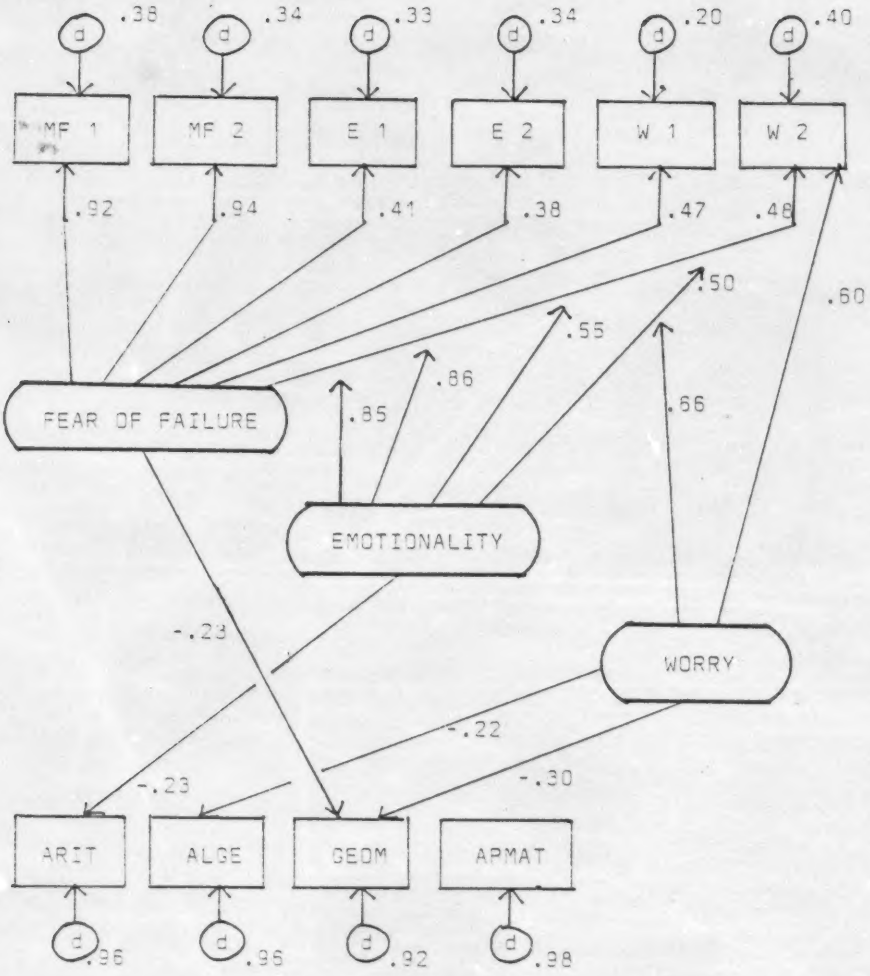

Figure 4. FaM - model for the informed group